User's Manual

Eye-BERT

Overview:

The Eye-BERT is a low cost, versatile, all-in-one fiber optic test solution capable of performing both optical and electrical bit error rate testing as well as serving as a digital E/O and O/E converter. The Eye-BERT offers high performance bit error rate testing at a fraction of the cost while providing a rich set of features not found in other bit error rate testers, including: E/O conversion, stand-alone and USB operation, optical power monitoring, internal CDRs, recovered clock outputs, and internal data logging memory.

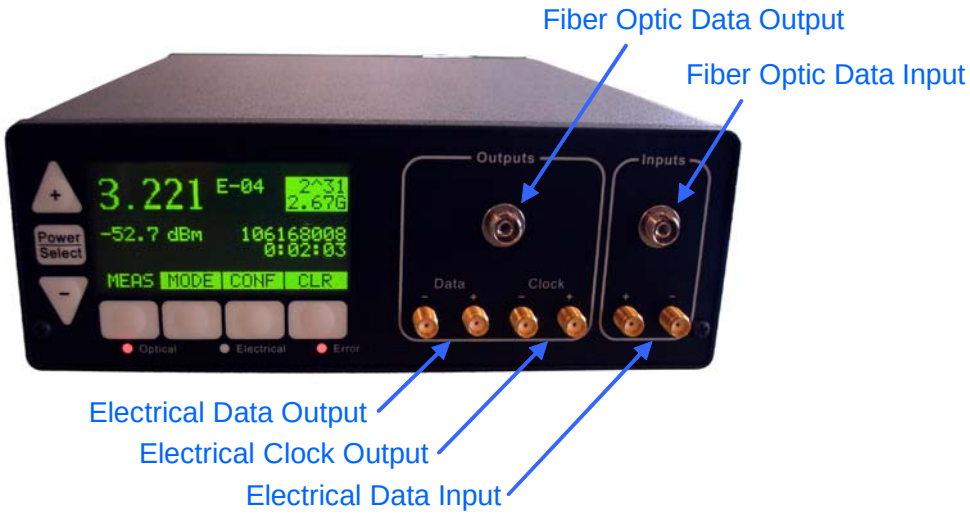
The Eye-BERT can be operated in stand alone mode by using the front panel controls or by using a computer and USB connection. Both modes of operation are described in this manual.

Warnings and Precautions:

- ❒ Do not exceed 0dBm optical input power on any optical port
- ❒ Use only compatible fiber optical connections (FC/UPC unless otherwise noted)
- ❒ Do not exceed 2Vpp on any electrical input or output
- ❒ Use only the supplied 5VDC power supply
- ❒ Observe ESD precautions when using electrical interfaces

Connections:

The figure below shows the front panel connections; the above precautions should be observed when interfacing to them. The operating mode determines the function of the various interfaces and the table below gives a brief description of the function as it relates to the operating mode.



	Mode		
Interface	E/O & O/E Converter	Optical BERT	Electrical BERT
Optical Input	NRZ input signal, retimed if a valid bit rate and K28.5 symbols are detected	Signal to be measured, connected to CDR and pattern detector	Inactive
Optical Output	Regenerated signal at electrical input	Connected to pattern generator	Inactive
Electrical Input	NRZ input signal, retimed if a valid bit rate and K28.5 symbols are detected	Inactive	Signal to be measured, connected to CDR and pattern detector
Electrical Output	Regenerated signal at optical input	Inactive	Connected to pattern generator
Clock Output	Half-rate clock locked to electrical output if optical input is locked	Inactive	Half-rate clock locked to electrical output

Fiber Optic Interfaces

Refer to the Eye-BERT part number for supported bit rates, output wavelength, fiber type, and connector.

Electrical Data Inputs

Differential electrical inputs are AC coupled into 50Ω. By terminating the unused port the electrical interfaces may be used as single ended with reduced performance.

Electrical Data Outputs

Differential electrical outputs are AC coupled into 50Ω. By terminating the unused port the electrical interfaces may be used as single ended with reduced performance.

Electrical Clock Outputs

The clock output is a half-rate clock normally locked to the electrical output per the table above. Differential clock outputs are AC coupled into 50Ω. By terminating the unused port, the electrical interfaces may be used as single ended with reduced performance.

Stand Alone Operation:

In stand alone operation all functions and controls are available to the user via the front panel key pad and LCD. The following sections describe the operation of the front panel controls.

Powering the Unit On/Off

To turn the unit on or off, simply press and hold the “Power/Select” button for more than two seconds.

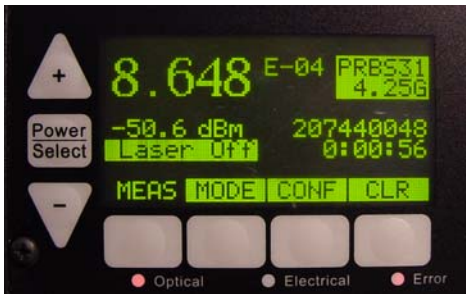
Changing Operating Mode

Press the “Mode” soft key and use the up / down buttons to highlight the desired mode, when the “Meas” soft key is pressed the change will take effect.

Changing the Configuration / Settings

Press the “Conf” soft key and use the “Power/Select” key to highlight the desired parameter; change the setting by using the up / down buttons. When the “Meas” soft key is pressed the change will take effect.

Optical and Electrical BERT Mode



The Optical BERT measurement screen is shown to the left and displays all the associated measurement parameters. The actual bit error rate is displayed in the upper left corner with the optical input power below. The pattern and bit rate settings are displayed in the upper right corner with the actual error count and test time just below. The laser can be turned on or off by pressing the “power/select” button and is indicated below the optical power read out.

The “Optical” LED reflects the state of the optical input, a red indication is displayed when there is no optical input signal and a flashing green LED indicates that an optical signal has been detected but the pattern detector is not synchronized. A solid green LED is displayed when the pattern detector is locked and BER is being measured. The “Error” LED shows the error history: green indicates that no errors have been detected and conversely, red indicates errors have been received. The error counters can be reset by pressing the “CLR” soft key.

The Electrical BERT mode operates in the same way and uses the same basic screen layout but the optical input power level is not displayed.

Notes:

- Only the PRBS7, PRBS23, PRBS31, and K28.5 patterns can be used for bit error rate measurement; the CJTPAT, CRPAT, and CSPAT signals are intended to be used for jitter testing only.
- In BERT modes the pattern detector runs synchronously with the pattern generator and therefore will only detect its own internally generated synchronous data pattern. The pattern detector constantly adjusts its sampling parameters so that no user interaction is required.

E/O & O/E Converter Mode

The E/O & O/E Converter measurement screen is shown to the left and displays all the associated measurement parameters. In this mode the Eye-BERT converts the optical input signal to an electrical output and the electrical input to optical output. The unit automatically searches for K28.5 symbols at the predefined data rates, and once detected, displays the bit rate, retimes the output data, and generates a recovered optical half rate clock output.

If detected, the actual data rates are displayed in the upper portion of the screen with the optical on the left. Additionally the optical input power is displayed below the bit rate.

The optical and electrical LEDs reflect the state of the inputs in the same manor as in the BERT modes.

- Note: If the two paths are operating at different data rates, only one will be able to lock and retime its output.

Memory Clearing

The Eye-BERT contains a large amount of non-volatile logging memory and in some cases it may be desirable to clear this memory. To do this, while the unit is powered off, press and hold the "Power/Select" button and "Up" arrow key simultaneously until the memory clearing screen is displayed, then follow the directions on the screen. Note, due to the large amount of memory it will take approximately 1 hour and 15 minutes to completely clear all memory locations. This clearing procedure erases all 256MB of user memory with the exception of nine bytes which are used to store configuration information, calibration constants, and power readings.

USB/GUI Operation

The Eye-BERT can be operated remotely via USB by using the supplied Eye-BERT GUI or custom controlling software. This guide describes the use of the supplied GUI only, please refer to the Software Programming Guide for additional information on interfacing with custom software.

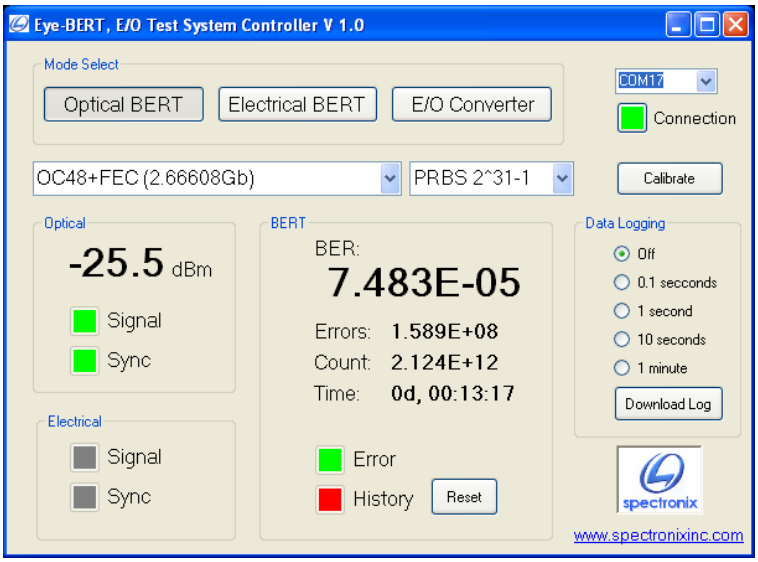
USB Driver:

In order for Windows to recognize the Eye-BERT the USB driver must first be installed; after which the Eye-BERT appears as an additional COM port on the computer.

1. Copy the file "cdc_NTXP.inf" from the supplied CD to the hard drive.
2. Plug the Eye-BERT into a free USB port. When the hardware installation wizard asks for the driver location, browse to the "cdc_NTXP.inf" file on the hard drive.
3. After the driver has been installed right click "my computer" and select "properties". In the properties window select the "hardware" tab. Click on "device manager" and expand the "Ports (COM & LPT)" item. Locate the "Spectronix, Inc." entry and note the assigned Com number, (ie "COM4"). This is the COM port that the software will use to communicate with the Eye-BERT.

Using the Supplied Eye-BERT Application

The Eye-BERT must be connected to a USB port prior to launching the Eye-BERT utility. Upon initialization, the application generates a list of valid COM ports under the "Select Port" drop down list. Before the software can communicate with the Eye-BERT the user must select the proper port in the drop down list per step 3 above. Normally, as long as the same USB port is used the COM port number will not change.



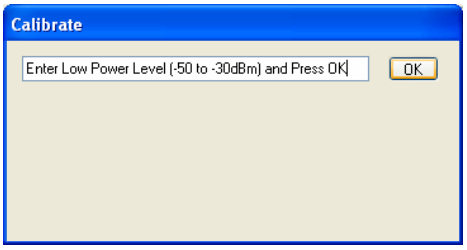
After the proper port is selected the "Connection" indicator will turn green and the screen will be populated with the current measurements. The user may change the mode of operation using the three buttons near the top of the screen, change the bit rate and pattern using the drop down lists, or reset the error counters with the "Reset" button.

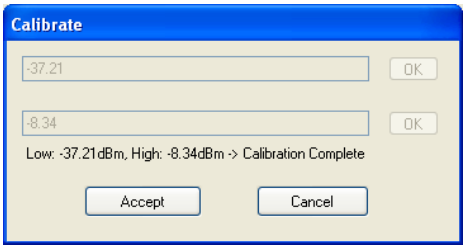
Calibration

Note: Calibration is required for the Eye-BERT (100213A) version 1.x and below. Version 2.0 and above utilizes the transceiver module for receive power measurements and therefore require no calibration. Executing the calibration procedure below on version 2.0 and above will have no effect.

A calibrate button is provided to allow the user to recalibrate the optical power monitor. When this button is selected the pop-up window shown to the left asks the user to adjust the input power to between -50 and -30dBm; the ***actual*** power level should be entered in the box and ***after it has been connected to the optical input*** the user should press the OK button.

After pressing OK the user will be asked to repeat the procedure with a high power level between -10 and 0dBm. After pressing OK, the user has the option to accept the calibration or to cancel. If the calibration is accepted it will be written into non volatile memory.





Data Logging

Data logging can be initiated at one of four intervals either through the front panel controls or the software interface. The "Download Log" button is used to retrieve the logged data and save it to the system's hard drive. The user will be prompted to select a file name and destination for the log file; the format is an Excel© compatible comma separated file, an example is shown below. Note that the log files can become very large and will thus take a long time to down load; typically the interface will support a transfer rate of about 10,000 samples per minute.

Eye-BERT Log file (40 samples) Downloaded: 10/13/2008 2:04:04 PM

Sample	Mode	Rate	Pattern	LogInt	Power	Optical	Electrical	Count	Errors
1	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.12E+10	60230
2	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.14E+10	60652
3	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.19E+10	61457
4	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.23E+10	62315
5	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.27E+10	63174
6	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.31E+10	63855
7	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.36E+10	64292
8	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.4E+10	64592
9	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.44E+10	64711
10	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.48E+10	64766
11	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.52E+10	64814
12	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.57E+10	64871
13	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.57E+10	64871
14	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.65E+10	65090
15	O-BERT	4x Fiber Channel (4.25Gb)	PRBS31	100	-7.9	Sync	NA	7.65E+10	65090

The error rate is calculated by taking the ratio of errors to the total bit count.